TELEDYNE COUGAR

A Teledyne Technologies Company

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www.teledyne-cougar.com • email:Amp@cougarcorp.com

100 kHz TO 20 GHz SIGNAL PROCESSING PRODUCTS AND INTEGRATED ASSEMBLIES

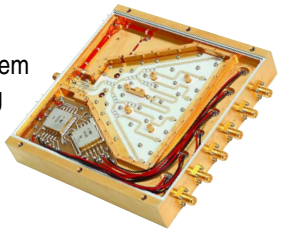
COMPANY DESCRIPTION

Teledyne Cougar, Inc., a Teledyne Technologies Company, with facilities in both Sunnyvale, CA and Lakewood, CO, designs and manufactures RF and microwave components, integrated assemblies and value add services for aerospace, defense, and industrial applications.Cougar's product line encompasses over 700 models and thousands of custom variations to 20 GHz.

COMPONENTS

Cougar offers design engineers the most comprehensive selection of performance RF and microwave components available. Cougar's component designs include RF cascadable and microwave amplifiers covering frequencies from 100 KHz to 20 GHz, voltage controlled oscillators, frequency mixers, frequency doublers, power dividers, IQ networks, analog and threshold detectors,limiters,limiting amplifiers, voltage controlled attenuators, automatic gain control amplifiers, and switches.

INTEGRATED ASSEMBLIES



For robust first-level integration capabilities, Cougar provides both performance components and full subsystem solutions. Cougar delivers customer-specified subsystems of analog and mixed analog-digital designs, including hybrid, MMIC, mixed hybrid-MMIC configurations. Designed to meet industrial, defense and aerospace applications, Cougar's integrations include I/Q demodulators, coupled detector assemblies, switched amplifier assemblies, six-channel downconverters, and dual band VCOs.

VALUE ADD SERVICES

Teledyne Cougar now offers customers value-added services - complete die, hybrid and production services-including high reliability screening, parametric testing (DC and RF, small signal to 40 GHz, power to 500watts CW), environmental screening, chip and wire assembly, wafer and die storage, die/MMIC packaging and testing, tape and reel packaging, lead trim/form, solder dip, and color marking/dotting. Our facility space of 48K sq.ft. includes 20K sq.ft.of clean room area.

TECHNOLOGIES AND MARKETS

Our in-house manufacturing processes include eutectic and epoxy attachment; plasma cleaning;gold wedge, ball and ribbon bonding (manual and automatic); micro welding; hermetic sealing (seam and projection). Cougar provides full range of screening and environmental testing capabilities, including temperature cycle; acceleration; PIND test; fine and gross leak, full element/component/subsystem burn-in.

SPACE: Space is the most challenging environment for hybrid applications. Teledyne Cougar's proud of successes on such programs as Advanced EFH, SBIRS HIGH, Wideband Gapfiller, Skynet 5, MUOS and GPS.

MILITARY: Cougar provides performance components for all types of military applications - surveillance, radar, communications and guidance systems. We contribute to F/A-22, JTRS, B2Upgrade, Patriot Upgrade (PAC-3), Longbow Apache, Rivit Joint and DDG-1000 Navy Antenna platforms.

INDUSTRIAL: Cougar's commercial and industrial products employ the same high levels of workmanship as our space and military lines. Our responsiveness and complete manufacturing capabilities help engineering and purchasing manage the balance between performance, cost, and schedule.

CERTIFICATIONS / QUALITY IMPROVEMENT

Cougar employs a robust continuous quality improvement program that focuses on Lean Manufacturing.Cougar is certified to ISO 9001-2000 and MIL-PRF-38534, Classes H and K (TRB Option), AS9100 (pending) and is ITAR Registered and Compliant.

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AMPS - 100 kHz to 20 GHz

Virtually all of Cougar's amplifiers are designed for excellent stability and cascadability. Gain flatness is maintained to typically ±0.2 dB or better, which improves cascaded flatness. All DC biasing circuits use temperature compensating bias to reduce DC current drift to typically ±0.3% from –55°C to+85°C case temperatures. The nominal bias on many of the models is 15 volts, while others are designed to operate in the 5- to 8-volt range. High frequency models are based upon proven balanced designs utilizing Lange couplers for broadband performance and excellent VSWR.

Cougar cascadable package types include: through hole TO-8 and TO-8B, SMA connectorized housings, flat-packs, both SMTO-8 and SMTO-8B surface mount packages and CougarPak® models.

Model	Frequency	Gain (dB)	N.F. (dB)	Power Out (dBm)	DC (V)	DC (mA)
LOW NOISE AMPS						
AC688	200-600 MHz	21.5	**0.8**	22.0	5	85
AC1691	900-1600 MHz	17.5	**1.0**	21.0	5	05
A2CP104	1-100 MHz	8.4	**1.5**	22.5	15	43
HIGH POWER AMPS						
AP2009	10-2000 MHz	11.0	3.5	**28.0**	15	188
AR1298	10-1200 MHz	11.5	4.0	**30.5**	15	410
AFT6091	3000-6000 MHz	15.0	6.0	**33.0**	8	650
A2CP6139	1.5-6 GHz	13.0	4.0	**33.0**	15	1500
HIGH FREQUENCY AMPS						
A2CP18225	**10-18 GHz**	15.0	4.5	25.5	12	325
ACP20215	**2-20 GHz**	20.0	4.8	18.0	5	156
AFT20015	**2-20 GHz**	10.0	4.5	16.0	5	76
HIGH IP3 AMPS – IP3 ≥ 40						
AP3009	20-3000 MHz	12.0	3.0	27.5	15	190
A2CP6239	2-6 GHz	13.0	4.0	33.0	15	1500
ACP14029	8-14 GHz	6.5	5.0	29.0	12	350

All specifications are typical.

MIXERS, DOUBLERS, IQ NETWORKS

Model	Frequency Range RF	LO	IF	Lo Power Nominal (dBm)	Conv. Loss N.F. (dB)	IP3/ IP2 (dBm)
MCH3008	5-1000 MHz	10-1500 MHz	1-500 MHz	10	6.0	20/50
	1-3000 MHz	1-3100 MHz	1-2000 MHz		7.0	20/50
	1-3400 MHz	1-3400 MHz	1-2000 MHz		8.0	20/50
MMP20281	2-20 GHz	2-20 GHz	0.005-2 GHz	13	7.0	18/42
	2-20 GHz	2-20 GHz	2-4 GHz		7.0	
	2-20 GHz	2-20 GHz	4-6 GHz		8.5	
IQM15101	10.5-14.5 GHz	10.5-14.5 GHz	DC-500 MHz	13	6.3	—
IRM11623	6.2-10.8 GHz	6.2-10.8 GHz	DC-500 MHz	13	5.0	—

All specifications are typical.

Cougar continues to expand its line of frequency products to meet high performance applications from DC to 20 GHz. Our double- and triple-balanced mixer designs use Schottky-diodes and transformers for reliability and performance.

New frequency products now include frequency doublers, IQ Networks with IQ modulators, IQ Demodlators and image reject mixers.

VCOs

Cougar's VCO circuits are designed using silicon bipolar transistors and silicon varactor diodes for best overall phase noise performance and lowest settling time. 50 MHz to 9 GHz oscillators use a fundamental oscillator approach while 9 to 20 GHz oscillators use a doubling oscillator approach. Each oscillator is designed to work over –55°C to +85°C.

Model	Freq Range (GHz)	Tuning Voltage Range (Volts)	Nom. Modulation Sensitivity (MHz/V)	Phase Noise Offset at 10kHz/100kHz (dBc/Hz)	Harm. Supp. (dBc)	DC Bias Voltage (Volts)	DC Bias Current (mA)
OC2000	1.35–2.0	0-15	75	-78/-107	-12	15	55
OAS5100	4.3–5.1	0-15	65	-84/-108	-25	5	95
OAS7700	5.7–7.7	0-15	150	-75/-100	-25	5	95
OS6700	5.4–6.7	0-15	100	-75/-100	-17	5	25
OS8900	6.9–8.9	0-15	150	-70/-95	-25	5	24

All specifications are typical.

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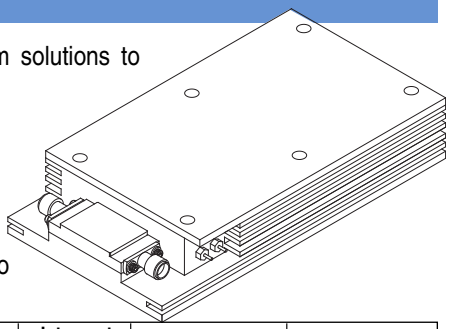
INTEGRATED ASSEMBLIES

Cougar offers full first-level integration capabilities; performance components plus full subsystem solutions to reduce program schedule and cost. Following are examples of our integrated assemblies.



CCM1095 & CCM2096 — 3 TO 5 WATT POWER AMPLIFIERS

The CCM1095 and CCM2096 are power amplifier that use current efficient Silicon Carbide output semi-conductors to achieve +35 to +38 dBm output power. The housing shown includes the RF amplifier and the voltage sequencer and provides over 15 sq. inches of mounting surface area to maintain cool operation.

Model	Frequency Range MHz	Small Signal Gain dB		Gain Flatness ±dB		Noise Figure dB		Power Output At 1dB Compression dBm		Rev. Iso. dB	Intercept Point dBm	SWR In/Out		D.C.	
		Typ.	Min. -40/71C	Max. 0/50C	Max. -40/71C	Typ.	Max. -40/71C	Typ.	Min. -40/71C		3rd/2nd Typ.	Max. Typ.	Max. -40/71C	Volts Nom.	mA Typ.
CCM1095	50-1000	11.5	10.0	0.5	0.7	4.0^	5.0	**36.0**	34.0	19	47/58	1.8:1	2.0:1	28	500
	50-1000	11.5	10.0	0.5	0.7	4.0^	5.0	**36.5**	35.0	19	48/60	1.8:1	2.0:1	32	500
	50-1000	11.5	10.0	0.5	0.7	4.0^	5.0	**37.0**	36.0	19	48/60	1.8:1	2.0:1	36	500
CCM2096	50-2000	22.0	20.5	0.5	0.7	4.1^	5.0	**35.5**	34.0	35	46/57	2.1:1	2.1:1	15/28	450/500
	50-2000	22.0	20.5	0.5	0.7	4.3^	5.0	**36.5**	35.0	35	47/58	2.1:1	2.1:1	15/36	450500

2 TO 18 GHZ AMPLITUDE AND PHASE MATCHED 6 CHANNEL DOWNCONVERTER

Six channel 2 to 18 GHz (RF and LO) Downconverter operates at IF frequency of ~960 MHz with 25 dB of RF to IF gain and bandwidth of ~500 MHz. The LO signal provided to the mixers is conditioned by being amplified, power split and then individually amplified again for each channel. Integrated into every channel is a range extension switch adding 20 dB of range by inserting 20 dB of attenuation. Six 2 to 18 GHz switches are controlled by a single "TTL" input. Noise figure is ~13.5 dB with the output IP3 of ~25 dBm. Channel to amplitude match is ~1.0 dB 0and the channel to channel phase match is <20°.

X BAND LIMITING AMPLIFIER

- 9 to 10 GHz Frequency
- +28.5 dBm Output Power
- ±0.3 Output Power Change Vs. Frequency and Temperature (-46° to 72° C)
- Operates off 400 Hz 115 VAC Supply

DETECTORS

Cougar's designs incorporate either planar germanium tunnel diodes or silicon Schottky diodes with video amplifiers and comparators to provide analog or threshold detector functional blocks. Precision video components offer low-level detection with low output offset voltage while high speed video models provide fast pulse response at generally lower dynamic range. All designs focus on flat frequency response, low VSWR and good temperature stability.

ANALOG DETECTORS

Model	Freq Range (GHz)	Input Power (dBm)	Power Flatness ±(dB)	Sensitivity Vout @Pref (mV)	Pulse Resp. (µs)	VSWR Input	Vs/Is ±(V/mA)
DAQ6101	0.1–6.0	-30 to 5	0.50	120	1.5	1.5	5/2
DAS8121	0.5–8.0	-30 to 5	0.50	140	0.02	1.5	5/9
DAQ10501	0.05–10.0	-30 to 5	0.75	120	1.5	1.5	5/2

THRESHOLD DETECTORS

Model	Freq Range (GHz)	Input Power (dBm)	Power Flatness ±(dB)	Hysteresis (dB)	Pulse Resp. (µs)	VSWR Input	Vs/Is (V/±mA)
DTC6002	0.01–6.0	-30 to -5	0.50	0.2	50	1.5	5/2.5
DTS6014	0.1–6.0	-12 to 12	0.50	0.3	0.8	1.5	5/2
DTCP18001	2.0–18.0	-25 to -5	1.0	0.5	50	1.5	5/2.5

All specifications are typical.

INTEGRATED SOLUTIONS

Integrated assemblies designed by Teledyne Cougar are engineered for optimal system performance and reliability. Our component expertise provides a solid foundation for each integrated assembly we design.

Designers select Teledyne Cougar as their first choice for integrated solutions to meet performance, reliability, and cost goals. Cougar can provide integrated assembly solutions, combining multiple functions and reducing your design and manufacturing challenges. Cougar's integrations can include analog and mixed analog-digital designs of hybrid, MMIC, lumped element and mixed configurations.

Whether your application is industrial, military or space, Cougar's experienced engineering staff provides integrated solutions to solve component interface difficulties, reduce size, meet schedule deadlines, and exceed all of your performance goals.

Pictured: Six (6) channel 2 to 18 GHz (RF and LO) Downconverter that operates at an IF frequency of ~960 MHz with 25 dB of RF to IF gain and bandwidth of ~500 MHz. The downconverter is a two sided, hermetically sealed hybrid designed for rugged military applications and is but one of many integrated assemblies developed by Cougar.

QUALITY • PERFORMANCE • ON TIME

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ISO 9001-2000 • MIL-PRF-38534
Class H & Class K Certified

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for over 19 years.

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